Summary

(a) The three type of loops available in C are **for**, **while**, and **do-while**.
(b) A **break** statement takes the execution control out of the loop.
(c) A **continue** statement skips the execution of the statements after it and takes the control to the beginning of the loop.
(d) A **do-while** loop is used to ensure that the statements within the loop are executed at least once.
(e) The ++ operator increments the operand by 1, whereas, the -- operator decrements it by 1.
(f) The operators +=, -=, *=, /=, %= are compound assignment operators. They modify the value of the operand to the left of them.

Exercise

while Loop

[A] What would be the output of the following programs:

(a)
```
main( )
{
    int  j ;
    while ( j <= 10 )
    {
        printf ( "\n%d", j ) ;
        j = j + 1 ;
    }
}
```

j is not assigned to any value

(b)
```
main( )
{
    int  i = 1 ;
    while ( i <= 10 ) ;
    {
        printf ( "\n%d", i ) ;
```

Out PUT
1
2
3
4
5
6
7
8
9
10

```
            i++ ;
        }
    }
```

(c)
```
main( )
{
    int  j ;
    while ( j <= 10 )
    {
        printf ( "\n%d", j ) ;
        j = j + 1 ;
    }
}
```

j is not assigned to any value

(d)
```
main( )
{
    int  x = 1 ;
    while ( x == 1 )
    {
        x = x - 1 ;
        printf ( "\n%d", x ) ;
    }
}
```

OUTPUT
0

(e)
```
main( )
{
    int  x = 1 ;
    while ( x == 1 )
        x = x - 1 ;
    printf ( "\n%d", x ) ;
}
```

Output
0

(f)
```
main( )
{
    char  x ;
```

```
        while ( x = 0 ; x <= 255 ; x++ )
            printf ( "\nAscii value %d Character %c", x, x ) ;
    }
```

ERROR

(g)
```
    main( )
    {
        int  x = 4, y, z ;
        y = --x ;
        z = x-- ;
        printf ( "\n%d %d %d", x, y, z ) ;
    }
```

OUTPUT
2 3 3

(h)
```
    main( )
    {
        int  x = 4, y = 3, z ;

        z = x-- -y ;
        printf ( "\n%d %d %d", x, y, z ) ;
    }
```

OUTPUT
3 3 1

(i)
```
    main( )
    {
        while ( 'a' < 'b' )
            printf ( "\nmalyalam is a palindrome" ) ;
    }
```

OUTPUT
malyalam is a palindrome

(j)
```
    main( )
    {
        int  i = 10 ;
        while ( i = 20 )
            printf ( "\nA computer buff!" ) ;
    }
```

ERROR

(k)
```
    main( )
    {
        int  i ;
        while ( i = 10 )
        {
```

LOGICAL ERROR

```
            printf ( "\n%d", i ) ;
            i = i + 1 ;
        }
    }
```

(l)
```
    main( )
    {
        float  x = 1.1 ;
        while ( x == 1.1 )
        {
            printf ( "\n%f", x ) ;
            x = x – 0.1 ;
        }
    }
```

OUTPUT
1.1

(m)
```
    main( )
    {
        while ( '1' < '2' )
            printf ( "\nIn while loop" ) ;
    }
```

OUTPUT
In while loop

(n)
```
    main( )
    {
        char  x ;
        for ( x = 0 ; x <= 255 ; x++ )
            printf ( "\nAscii value %d Character %c", x, x ) ;
    }
```

OUTPUT
Ascii value 0 Character NUL
(up to 255)

(o)
```
    main( )
    {
        int  x = 4, y = 0, z ;
        while ( x >= 0 )
        {
            x-- ;
            y++ ;
            if ( x == y )
```

```
            continue ;
        else
            printf ( "\n%d %d", x, y ) ;
    }
}
```

(p)
```
main( )
{
    int  x = 4, y = 0, z ;
    while ( x >= 0 )
    {                                   4 0
        if ( x == y )                   3 1
            break ;
        else
            printf ( "\n%d %d", x, y ) ;
        x-- ;
        y++ ;
    }
}
```

[B] Attempt the following:

(a) Write a program to calculate overtime pay of 10 employees. Overtime is paid at the rate of Rs. 12.00 per hour for every hour worked above 40 hours. Assume that employees do not work for fractional part of an hour.

(b) Write a program to find the factorial value of any number entered through the keyboard.

(c) Two numbers are entered through the keyboard. Write a program to find the value of one number raised to the power of another.

(d) Write a program to print all the ASCII values and their equivalent characters using a **while** loop. The ASCII values vary from 0 to 255.

(e) Write a program to print out all Armstrong numbers between 1 and 500. If sum of cubes of each digit of the number is equal to the number itself, then the number is called an Armstrong number. For example, 153 = (1 * 1 * 1) + (5 * 5 * 5) + (3 * 3 * 3)

(f) Write a program for a matchstick game being played between the computer and a user. Your program should ensure that the computer always wins. Rules for the game are as follows:

- There are 21 matchsticks.
- The computer asks the player to pick 1, 2, 3, or 4 matchsticks.
- After the person picks, the computer does its picking.
- Whoever is forced to pick up the last matchstick loses the game.

(g) Write a program to enter the numbers till the user wants and at the end it should display the count of positive, negative and zeros entered.

(h) Write a program to find the octal equivalent of the entered number.

(i) Write a program to find the range of a set of numbers. Range is the difference between the smallest and biggest number in the list.

for, break, continue, do-while

[C] What would be the output of the following programs:

(a)
```
main( )
{
    int  i = 0 ;
    for ( ; i ; )
```

```
        printf ( "\nHere is some mail for you" ) ;
}
```

(b)
```
main( )
{
    int  i ;
    for ( i = 1 ; i <= 5 ; printf ( "\n%d", i ) ) ;
        i++ ;
}
```

(c)
```
main( )
{
    int  i = 1, j = 1 ;
    for ( ; ; )
    {
        if ( i > 5 )
            break ;
        else
            j += i ;
        printf ( "\n%d", j ) ;
        i += j ;
    }
}
```

(d)
```
main( )
{
    int  i ;
    for ( i = 1 ; i <= 5 ; printf ( "\n%c", 65 ) ) ;
        i++ ;
}
```

[D] Answer the following:

(a) The three parts of the loop expression in the **for** loop are:

the i_____ expression
the t_____ expression
the i_____ expression

(b) An expression contains relational operators, assignment operators, and arithmetic operators. In the absence of parentheses, they will be evaluated in which of the following order:

1. assignment, relational, arithmetic
2. arithmetic, relational, assignment
3. relational, arithmetic, assignment
4. assignment, arithmetic, relational

(c) The **break** statement is used to exit from:

1. an **if** statement
2. a **for** loop
3. a program
4. the **main( )** function

(d) A **do-while** loop is useful when we want that the statements within the loop must be executed:

1. Only once
2. At least once
3. More than once
4. None of the above

(e) In what sequence the initialization, testing and execution of body is done in a do-while loop

1. Initialization, execution of body, testing
2. Execution of body, initialization, testing
3. Initialization, testing, execution of body
4. None of the above

(f) Which of the following is not an infinite loop.

1.
```
int i = 1 ;
while ( 1 )
{
   i++ ;
}
```

2.
```
for ( ; ; ) ;
```

```
3.  int True = 0, false ;
    while ( True )
    {
       False = 1 ;
    }
```

```
4.  int y, x = 0 ;
    do
    {
       y = x ;
    } while ( x == 0 ) ;
```

(g) Which of the following statement is used to take the control to the beginning of the loop?

1. exit
2. break
3. continue
4. None of the above

[E] Attempt the following:

(a) Write a program to print all prime numbers from 1 to 300. (Hint: Use nested loops, **break** and **continue**)

(b) Write a program to fill the entire screen with a smiling face. The smiling face has an ASCII value 1.

(c) Write a program to add first seven terms of the following series using a **for** loop:

$$\frac{1}{1!} + \frac{2}{2!} + \frac{3}{3!} + \ldots\ldots$$

(d) Write a program to generate all combinations of 1, 2 and 3 using **for** loop.

(e) According to a study, the approximate level of intelligence of a person can be calculated using the following formula:

```
i = 2 + ( y + 0.5 x )
```

Write a program, which will produce a table of values of **i**, **y** and **x**, where **y** varies from 1 to 6, and, for each value of **y**, **x** varies from 5.5 to 12.5 in steps of 0.5.

(f) Write a program to produce the following output:

```
A B C D E F G F E D C B A
A B C D E F   F E D C B A
A B C D E       E D C B A
A B C D           D C B A
A B C               C B A
A B                   B A
A                       A
```

(g) Write a program to fill the entire screen with diamond and heart alternatively. The ASCII value for heart is 3 and that of diamond is 4.

(h) Write a program to print the multiplication table of the number entered by the user. The table should get displayed in the following form.

```
29 * 1 = 29
29 * 2 = 58
…
```

(i) Write a program to produce the following output:

```
          1
      2       3
  4       5       6
7       8       9       10
```

(j) Write a program to produce the following output:

```
                1
            1       1
        1       2       1
    1       3       3       1
1       4       6       4       1
```

(k) A machine is purchased which will produce earning of Rs. 1000 per year while it lasts. The machine costs Rs. 6000 and will have a salvage of Rs. 2000 when it is condemned. If 12 percent per annum can be earned on alternate investments what would be the minimum life of the machine to make it a more attractive investment compared to alternative investment?

(l) When interest compounds **q** times per year at an annual rate of **r** % for **n** years, the principle **p** compounds to an amount **a** as per the following formula

$$a = p\,(1 + r/q)^{nq}$$

Write a program to read 10 sets of **p, r, n** & **q** and calculate the corresponding as.

(m) The natural logarithm can be approximated by the following series.

$$\frac{x-1}{x} + \frac{1}{2}\left(\frac{x-1}{x}\right)^2 + \frac{1}{2}\left(\frac{x-1}{x}\right)^3 + \frac{1}{2}\left(\frac{x-1}{x}\right)^4 + \ldots.$$

If **x** is input through the keyboard, write a program to calculate the sum of first seven terms of this series.